Using Sulphate Activated Pozzolans in Controlled Low Strength Materials

- Project Partners and Sponsors
- Sulphate Activated Pozzolans
- Controlled Low Strength Materials
- Sources of Gypsum
- Other Materials
- Lab results
- Site Trial

Project Partners

- **Coventry University**
  - Dr Peter Claisse
  - Dr Esmaiel Ganjian
  - Elevtherios Gross
- **Imperial College London**
  - Professor Alan Atkinson
  - Dr Mark Tyrer
  - Rosemary Greaves
- **Birmingham University**
  - Dr Gurmel Ghataora

Project Sponsors

- The Mini-Waste Faraday Partnership
  - The Environmental and Physical Sciences Research Council
  - The Natural Environment Research Council
- Lafarge Plasterboard
- Huntsman Tioxide

The Mini-Waste Gypsum Project

- Sulphate activated pozzolans
  - Controlled Low Strength Materials
  - Products (blocks, floor screeds etc.)
  - Trench fill
  - Road bases
- Self-heated product forming
- Production of clean gypsum

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Sulphate Activated Pozzolans

- Super Sulphated Cement was made with blastfurnace slag and gypsum
- Widely used for foundations because of high sulphate resistance
- Discontinued due to poor shelf-life and the introduction of sulphate resisting cements.

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Controlled Low Strength Materials

- Low strength mixes for trench backfill etc.
- Not yet widely used in Europe.
- An alternative to foamed concrete for many applications.

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Current Uses of Gypsum

CLEAN MATERIAL

- cement
- plasterboard and plaster

CONTAMINATED MATERIAL

- soil conditioner

Sources of by-product Gypsum

- Flue gas desulphurisation
- Titanium oxide pigment production

- Plasterboard off-cuts
- Spent casting cores etc.

Red Gypsum

- A by-product of titanium dioxide production (white pigment).
- The red colour comes from iron oxide
- Many other contaminants
- Has been used in agriculture
- Current output 125,000 Tonnes per year

Red gypsum delivery at Roxby

Placed red gypsum at Roxby

Waste Plasterboard European Union Regulations

- Must be segregated on site
- Limited amounts can be recycled in the production process
- Cannot be landfilled with municipal waste (produces small amounts of hydrogen sulphide)
- No segregated cells available in the UK
- The organic content (paper) may prevent all landfilling

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Candidate materials (1)

- Sodium sulphate slag (Britannia Refined Metals Ltd.)
- Spent borax slag (Britannia Refined Metals Ltd.)
- Ferrosilicate slag (lumps from Britannia Refined Metals Ltd. sand size from Britannia Zinc Ltd.)
- Ferrosilicate copper slag (IMI Refiners Ltd.)
- Soda slag (Britannia Refined Metals Ltd.)
- Chrome Alumina slag **(**London & Scandinavian Metallurgical Co. Ltd.)
- Cement Kiln Dust ,CKD (Rugby Cement)
- Run of station ash (Ash Resources Ltd.)
- Lagoon ash (UK quality Ash Association)
- PFA (Ash Resources Ltd.)
- Steel slag (Tarmac Quarry Products Ltd.)
- Granulated Blast Furnace Slag, GBS (Tarmac Quarry Products Ltd.)

Candidate materials (2)

- Burnt Oil Shale (Tarmac Quarry Products Ltd.)
- By-product Gypsum (Biffa Waste Services Ltd.)
- Glass cullet (Mercury Recycling Ltd.)
- GGBS (Ground granulated blastfurnace slag)
- Limex70 (British Sugar Plc.)
- Shell foundry sand (Bruhl UK Ltd., Hepworth Minerals & Chemicals Ltd.)
- Green foundry sand (Castings Plc. And Bruhl UK Ltd.)
- Fire kettle setting (Britannia Refined Metals Ltd.)
- Fine rotary fascia bricks (Britannia Refined Metals Ltd.)
- Sodium sulphate solution (Britannia Refined Metals Ltd.)

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Initial Strength Results

	Percentages of components (blue if interground)										
Water/ solids ratio	Red Gypsum	Plasterboard Gypsum	Limestone calciner dust	Cement Kiln Dust	Dry Run of Stantion Ash	Steel Slag Dust	Steel Slag Dust, ground	Steel Slag Dust weathered	3 day strength	7 day strength	28 day strength
0.16	15	0	0	5	0	80	0		0.5	0.7	2.3
0.19	0	15	0	5	0	80	0		0.2	0.5	1.5
0.20	20	0	0	0	0		80		0.2	0.5	2.3
0.36	20	0	20	20	20		20		0.1	0.2	2.1
0.26	15	0	1	4	0	80	0		0.6		
0.20	15	0	0	5	0	80	0		1.8		
0.00	0	15	0	5	0		0	80	1.0		

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Site Trial Mix

- 1 Part Water
- 2 Parts Red Gypsum (40% water as supplied)
- 3 Parts Steel Slag (Basic Oxygen Slag)

Gypsum/Slag mix trial pour (mixing)

Gypsum/Slag mix trial pour

Thank You

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